

1 CLAIMS:

2 1. A method of depositing an aluminum nitride comprising layer  
3 over a semiconductor substrate comprising:

4 positioning a semiconductor substrate within a chemical vapor  
5 deposition reactor; and

6 feeding ammonia and at least one compound of the formula  $R_3Al$ ,  
7 where "R" is an alkyl group or a mixture of alkyl groups, to the  
8 reactor while the substrate is at a temperature of about 500°C or less  
9 and at a reactor pressure from about 100 mTorr to about 725 Torr  
10 effective to deposit a layer comprising aluminum nitride over the  
11 substrate at such temperature and reactor pressure.

12  
13 2. The method of claim 1 wherein substrate temperature and  
14 reactor pressure are maintained substantially constant during the feeding  
15 and deposit.

16  
17 3. The method of claim 1 wherein substrate temperature is  
18 greater than or equal to about 250°C during the feeding.

19  
20 4. The method of claim 1 wherein substrate temperature is  
21 from about 380°C to about 420°C during the feeding.

22  
23 5. The method of claim 1 wherein the aluminum nitride is  
24 substantially amorphous.

10041896-010702

1           6.    The method of claim 1 wherein the reactor is void of  
2 plasma during the depositing.

3  
4           7.    The method of claim 1 wherein the compound comprises  
5 triethylaluminum.

6  
7           8.    The method of claim 1 wherein the compound comprises  
8 trimethylaluminum.

9  
10          9.    The method of claim 1 wherein the compound comprises at  
11 least two different alkyl groups.

12  
13          10.   The method of claim 1 wherein the compound comprises at  
14 least one methyl group and at least one ethyl group.

15  
16  
17  
18  
19  
20  
21  
22  
23  
24

11. A method of forming DRAM circuitry comprising:  
forming a first capacitor electrode over a substrate;  
feeding ammonia and at least one compound of the formula  $R_3Al$ ,  
where "R" is an alkyl group or a mixture of alkyl groups, to a  
chemical vapor deposition reactor within which the substrate is received  
while at a temperature of about 500°C or less and at a reactor  
pressure from about 100 mTorr to about 725 Torr effective to deposit  
a capacitor dielectric layer comprising aluminum nitride over the first  
capacitor electrode;

forming a second capacitor electrode over the aluminum nitride  
comprising capacitor dielectric layer; and

providing a DRAM word line comprising a gate of a field effect  
transistor which has a pair of source/drain regions, one of the  
source/drain regions being provided in electrical connection with the first  
capacitor electrode, the other of the source drain regions being provided  
in electrical connection with a DRAM bit line.

12. The method of claim 11 wherein the compound comprises  
triethylaluminum.

13. The method of claim 11 wherein the compound comprises  
trimethylaluminum.



202010-06 10041896-010702

1 21. DRAM circuitry comprising:

2 an array of word lines forming gates of field effect transistors and  
3 an array of bit lines, individual field effect transistors comprising a pair  
4 of source/drain regions; and

5 a plurality of memory cell storage capacitors associated with the  
6 field effect transistors, individual storage capacitors comprising a first  
7 capacitor electrode in electrical connection with one of a pair of  
8 source/drain regions of one of the field effect transistors and a second  
9 capacitor electrode, a capacitor dielectric region received intermediate  
10 the first and second capacitor electrodes, the region comprising  
11 aluminum nitride, the other of the pair of source/drain regions of the  
12 one field effect transistor being in electrical connection with one of the  
13 bit lines.

14  
15 22. The circuitry of claim 21 wherein the region contacts each  
16 of the first and second capacitor electrodes and consists essentially of  
17 aluminum nitride.

18  
19 23. The circuitry of claim 21 wherein the region contacts each  
20 of the first and second capacitor electrodes and consists essentially of  
21 aluminum nitride and native oxide formed on at least one of the first  
22 and second capacitor electrodes.

24. The circuitry of claim 21 wherein the region contacts each of the first and second capacitor electrodes and has a thickness less than or equal to 60 Angstroms.

25. The circuitry of claim 21 wherein the region contacts each of the first and second capacitor electrodes and has a thickness less than or equal to 50 Angstroms.

26. The circuitry of claim 21 wherein the region contacts each of the first and second capacitor electrodes, consists essentially of aluminum nitride, and has a thickness less than or equal to 60 Angstroms.

27. The circuitry of claim 21 wherein the region contacts each of the first and second capacitor electrodes, consists essentially of aluminum nitride and native oxide formed on at least one of the first and second capacitor electrodes, and has a thickness less than or equal to 60 Angstroms.

28. The circuitry of claim 21 wherein the aluminum nitride is substantially amorphous.

2020-08-09 10:40:02

1 29. A method of forming a field emission device comprising:  
2 forming an electron emission substrate comprising emitters;  
3 providing the emission substrate within a chemical vapor deposition  
4 reactor;

5 feeding ammonia and at least one compound of the formula  $R_3Al$ ,  
6 where "R" is an alkyl group or a mixture of alkyl groups, to the  
7 reactor while the electron emission substrate is at a temperature of  
8 about 500°C or less and at a reactor pressure from about 100 mTorr  
9 to about 725 Torr effective to deposit a layer comprising aluminum  
10 nitride over at least a portion of the emitters; and

11 after the deposit, joining the electron emission substrate with an  
12 electron collector substrate.  
13

14 30. The method of claim 29 wherein the electron collector  
15 substrate comprises a face plate comprising phosphor, and comprising  
16 forming the device to comprise a field emission display.  
17

18 31. The method of claim 29 wherein the electron emission  
19 substrate comprises a conductive extraction grid formed outwardly of and  
20 spaced from the emitters, the deposit occurring after formation of the  
21 extraction grid.  
22  
23  
24

1           32. The method of claim 29 wherein the electron emission  
2 substrate comprises a conductive extraction grid formed outwardly of and  
3 spaced from the emitters, the deposit occurring after formation of the  
4 extraction grid and also occurring on the extraction grid.

5  
6           33. The method of claim 29 wherein the compound comprises  
7 triethylaluminum.

8  
9           34. The method of claim 29 wherein the compound comprises  
10 trimethylaluminum. *B*

11  
12           35. The method of claim 29 wherein the compound comprises  
13 at least two different alkyl groups.

14  
15           36. The method of claim 29 wherein the compound comprises  
16 at least one methyl group and at least one ethyl group.

17  
18           37. The method of claim 29 wherein electron emission substrate  
19 temperature is greater than or equal to about 250°C during the feeding.

20  
21           38. The method of claim 29 wherein electron emission substrate  
22 temperature is from about 380°C to about 420°C during the feeding.  
23  
24



202070-958400

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24

39. The method of claim 29 wherein electron emission substrate temperature and reactor pressure are maintained substantially constant during the feeding and deposit.

40. The method of claim 29 wherein the aluminum nitride is substantially amorphous.

41. The method of claim 29 wherein the reactor is void of plasma during the depositing.

42. A field emission device comprising:  
an electron emitter substrate comprising emitters having at least a partial covering comprising aluminum nitride; and  
an electrode collector substrate spaced from the electron emitter substrate.

43. The field emission device of claim 42 wherein the electron collector substrate comprises a face plate comprising phosphor, and the field emission device comprises a field emission display.

44. The field emission device of claim 42 wherein the electron emission substrate comprises a conductive extraction grid formed outwardly of and spaced from the emitters, the covering being received over the extraction grid.

202070-9687402

1           45. The field emission device of claim 42 wherein the electron  
2 emission substrate comprises a conductive extraction grid formed  
3 outwardly of and spaced from the emitters, aluminum nitride of the  
4 covering being in contact with the extraction grid.

5  
6           46. The field emission device of claim 42 wherein the emitter  
7 covering consists essentially of aluminum nitride.

8  
9           47. The field emission device of claim 42 wherein the emitter  
10 covering is void of oxide.

11  
12           48. The field emission device of claim 42 wherein the aluminum  
13 nitride is substantially amorphous.

14  
15           49. The field emission device of claim 42 wherein the covering  
16 comprises a thickness less than or equal to about 150 Angstroms.

17  
18           50. The field emission device of claim 42 wherein the covering  
19 comprises a thickness greater than or equal to about 50 Angstroms.

2024-12-06 10:10:02

1           51. A field emission device comprising:  
2           an electron emitter substrate comprising emitters having at least  
3           a partial covering comprising an electrically insulative material other  
4           than an oxide of silicon; and  
5           an electrode collector substrate spaced from the electron emitter  
6           substrate.

7  
8           52. The field emission device of claim 51 wherein the electron  
9           collector substrate comprises a face plate comprising phosphor, and the  
10          field emission device comprises a field emission display.

11  
12          53. The field emission device of claim 51 wherein the electron  
13          emission substrate comprises a conductive extraction grid formed  
14          outwardly of and spaced from the emitters, the covering being received  
15          over the extraction grid.

16  
17          54. The field emission device of claim 51 wherein the electron  
18          emission substrate comprises a conductive extraction grid formed  
19          outwardly of and spaced from the emitters, aluminum nitride of the  
20          covering being in contact with the extraction grid.

21  
22          55. The field emission device of claim 51 wherein the covering  
23          comprises a thickness less than or equal to about 150 Angstroms.  
24

1 56. The field emission device of claim 51 wherein the covering  
2 comprises a thickness greater than or equal to about 50 Angstroms.  
3  
4

add a3  
add D4

202070-9687400F

5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24